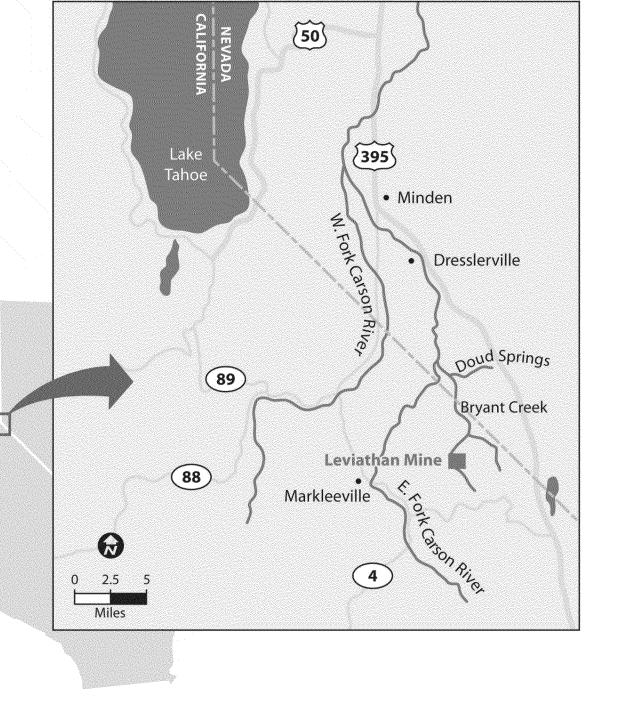
Leviathan Mine Superfund Site

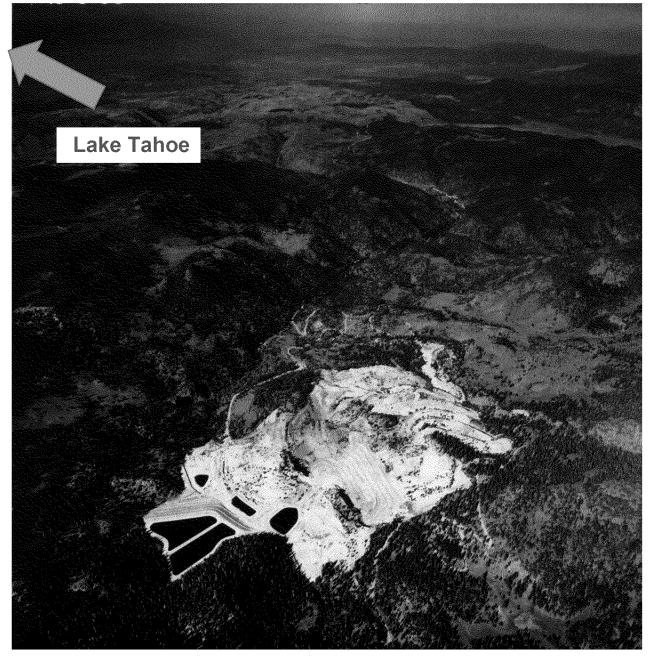
U.S.
Environmental
Protection Agency
Region 9

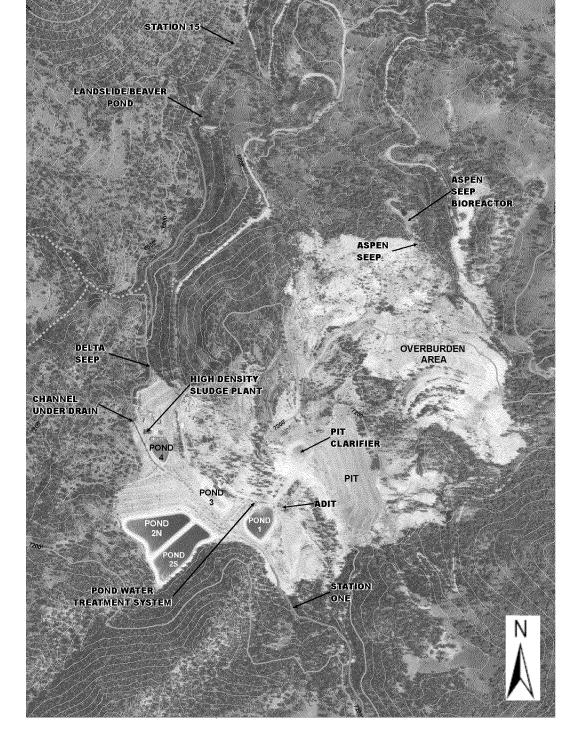
March 2017



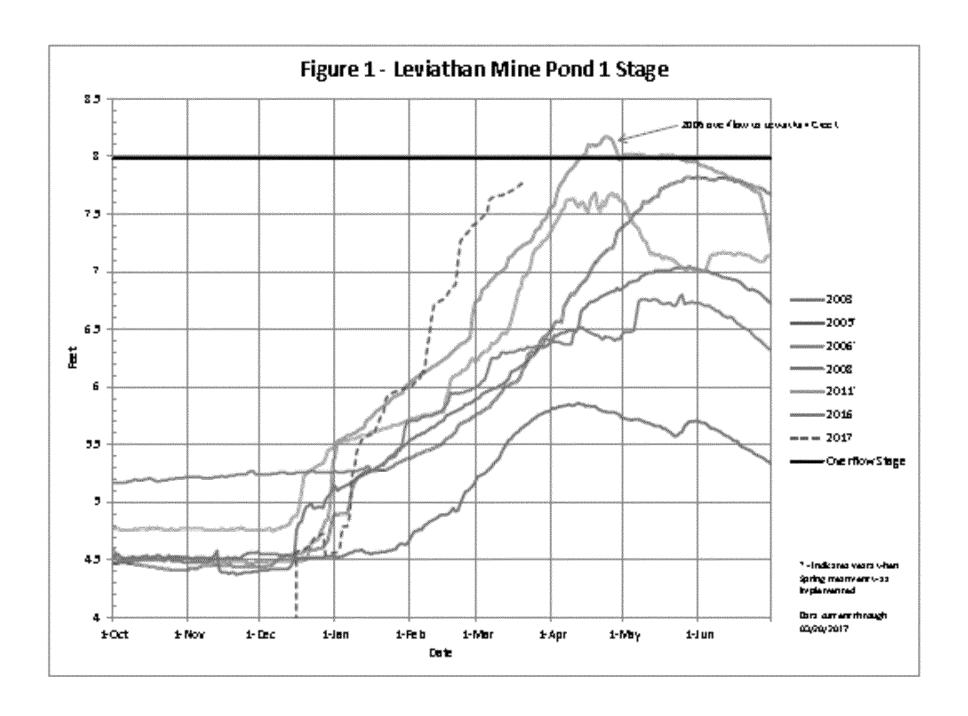
Leviathan Mine Alpine County, CA

- Abandoned open-pit sulfur mine. Listed on NPL 2000
- 24 Miles Southeast of Lake Tahoe
- Flows Northeast, to EFCR
- Impacts ~250 acres On site,
 ~750 acres Off site
- High elevation, inaccessible in winter
- Upstream from national forest, private, and Washoe land
- Interim Actions 80's;&
 Removal Actions still in place
- Remedial Investigation Ordered in 2008





- Since 2001, most AMD captured and treated before discharge to Leviathan Creek during summer
- This annual seasonal treatment significantly improved downstream water quality in Leviathan Creek
- The HDS plant does not captureAMD during the winter time.
- Storage Ponds collect water during the winter. However, overflow/ discharge did occur in 2005, 2006, and 2011
- Early Spring Treatment using a similar portable process was initiated in March 3, 2011



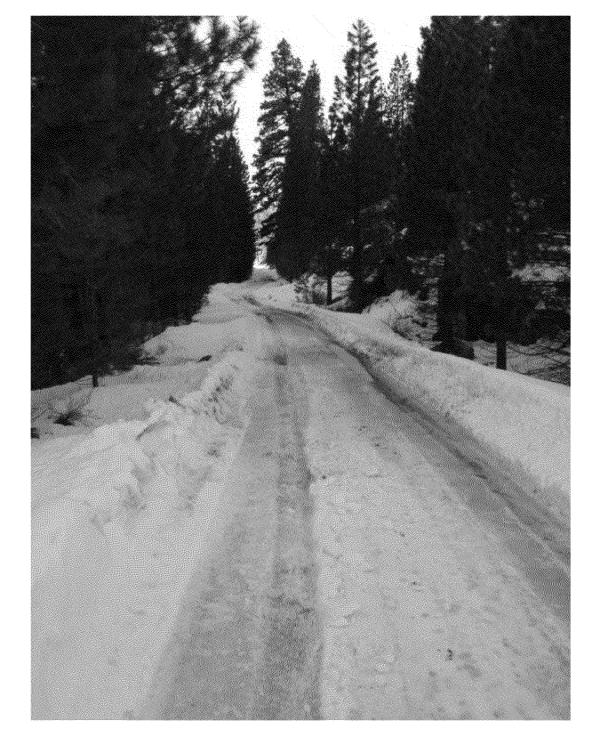
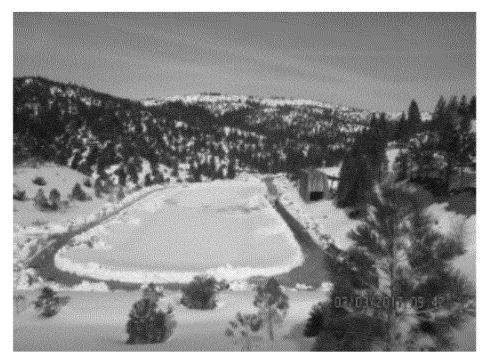




Photo 1 – Erosion on USPS Road 31052 dive to storm water runoff



ED_001709_00002214-00005



Photo 3 - TKT reutralizing AMD in Pond 3 with the PCTS shortly before discharge

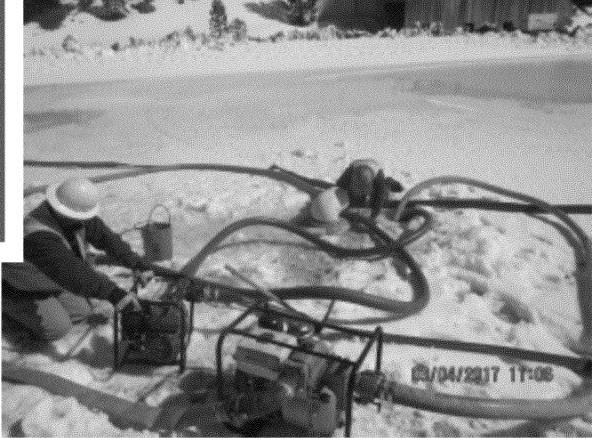


Photo 5 - Discharge of treated water from Pond 3 to Levisthan Creek visithe overflow structure. Treated water was pumped from below the ice layer.

imable L

20 L7 Spring Treatment, Levischen Mine Pond'S & immed Gischerge Volume

	blevia Gubie
Clair	Vetern (gettern)
aren i	DI JUL
ATM CATE!	41488
ACU (AID 1	υ γμ :
43/40	4181
A70 (A11 1	4 (#1

Intelligency between Charles

Velore 2420,000

teble2

20 t7 Spring framemen (Levischen Mine Universed Fond Were Sample Pavelis

25 00 0 E	les pla Saucepher	SO MATUR DOG 1 &	p+1	i inir	- CAL	ren	ي ي	·····	L	***	6	a wa	D-1#		E#	N.A.	G	PN 1		۵.	.m	New		N.,	2 P. M.A.	M+2	ı ad		nun		1 da 20, j	1	bartes to a	š	l#1.
	n Masemura Dead age 0		h.1-14			4		****************					1.3			F	1,1	MANAGEMENT .	3	1.3			*	- 1		8.3					<u> </u>	4	~		133
LON-FO-1-C	an design Dad age Di	Lmsa	7	<u> </u>		3		*	1.0	8 4		F	1.3	3		F	1.1	36	3	1.7	-		F	R		1.41	H	<u> </u>	11 b		~		~	<u> </u>	1.33
					Facul	E 000 NO	Femil	cace is c	Feult	CMC3 & 1	0 Fam. E.	00 40	Paul.	00 40	Floria B.	00 40	Pie sa. B.	OC + S	Fan. 8. 000		aa . a	Facult	00 40	Fault	00 k	Phus	00.0	Final	00 40	Fina L	00 40	Final L		Pie sa B	. 00 40
#74 11	Urliestra vides ir Para J	N/47/8039	2.	1.0	13		нали	П	L	П	40.1	П	HE3, 8.885	П	E.745	T.	1.13		1.8	HE3, E. 80	\prod	/3.3		#.3h.1	П	*TD	П	140	Ш	267	В	20.7		8.58	
*****	Unicodes nature Fare 1	814 MY	445	L.M	.,		£ 103	П	L#4	П	•	П	8.813		*	a	1.52			HE, 1. M	\prod	1.4		134	П	"ده		1.4m	П	22.	a	94		8.53	П
ENFAM4	Melionales walen in Para Januale	1045W -		1.8			1.77	П		П	24.7	П	8.446		1.201	П	1.10		141	HE, E. M.		14.5		7.83	П	1		1.12		174		1601			
127.584	United Salmin Para / Sault	answay.		1,1	b**.0		1.43	П		П	A3	П	8.718	П	140	\prod	1,23		23.1	HEL E		18.3		7.78	П	ıν		****	\prod	363	8	1,44		1.77	
IMPARI	Urinaka salmir Pem / Seult	MYAT	,,,,	1,2	144		8.00	\prod		П	22	П	1.701	Т	F4.	\prod	.,		6.3	140, 8.80	\prod	1.0		7.33	П	1.00		130	\prod	173		1778			Ш
100/48	University water or Fame / Secult	an y min	24.0	1.3				П		П		П									П				П										
EMMSEV:	Unionalma nulmor Familianait	MAN	.	1.2	Т			П				П				П					П				П						П				П

Indole 3 20 L7 Spring Treatment, Levischen Mine Pondá Discharge Sample Reule

3666714 10	3enda Dawider	30 MPUs Dois	941	i'a	Τ	rwin	ي ين		E		Τ.,	a um		***	-	0.4			Τ.				Nager		Nes		n		Ja be e			I da		Charles Series	-	Jw.	
***************************************				1.64							4	***************************************		~~~	4		4	**		: #T				***********				*********	-	***************************************	<u> </u>	30,1		*****	_	***************************************	
	Manual Debage D		A1-14	ļ		4		H	<u> </u>	11					*	*	_	13		3	1.23	***********		*			124				<u> </u>					133	******
LON FO 1 CL	n desirage Construção Co	Lanca				3	1 12	<u> </u>		14		~		33		7		13		3	121	<u> </u>		r		<u> </u>	1 115	*	L.	11	<u></u>	~		PP		133	
					Fie sa	E 00 W	Fault.	000 4.0	l Kaudi	œ.	O Facili		0 Kmw1	ac . c	Final	00 6	Pin sa B	CMC 6.0	Frank B.	00 40	Paul	00 .0	Fina all	00 WO	No sail L	CIC 140			Keult	00 40	Page 1	CBC) & C	Pana B	00			m
	Peral, briles	2/4/2 8 1 *	15.5		Τ	TT	T	П	T	П	T	П	140,	П	Π	TT		П	T	П		Т		\top	1,713	П		T		П	T	Π	T.,	П	П.		T
8 /00/01	erabagr	31-47-81 .		- 22	476		HOLLAN		L#/		3,7	┷	1.003		LM3	4-4-	***	4	E.71		110		14.5				8.7W		8350		787					12)	
m-CIME	Meraj, trains arabage	ATE AT	3.18	1.4	8,74		km/		HE3, 8 & 87				HC3,		s.m.		HD,	Ш	LV		HG, E. 88 1		78.7		1.43		8.830		1.413		7848	a	1388		- 8	HC3, 8.87	
#2021°	Merel, trains	AT A ATT	a)		Đ,		LW/	П	HO, I J II	П	,u1	П	1404 11.883	П	LUI		1.00	П	L.P	П	HC, E M 1	Т	2,0	Т	1.41	П	8.833	Т	1.58*			l.	3.5	П	Π,		T
	Perad, broles		***************************************		T	TT	1	П	1	П	1	\sqcap	1	П	T	TT	T	\Box	T	TT		T				П		T		П	T	TT	T	TT	T		T
11.00.01.	weak mer	MWAN	13.1	14	<u></u>				<u> </u>			ᄔ			<u> </u>	$\bot \bot$			1						L				L		L			$\bot \bot$	L		丄
HADDELLI.	fered, trains enabetr	ירות ערע	355	1.4		TT		П		П		П		П					T	П								T		П		П		П	T		T

tällsakersepaden medigam prokkerengtij narpi pit obah arreitamassitirih ara bengsiakershab ammithevedsspratmaakass Lälgassentresam anaken aangi telmasmitish istolitesa makki.

differently are performance.

HF - Hall Karmalgales

Hite-Hell timely.com

*-årdvisninaltyprerg Lingborullesprer, lätfällick hinespräksbyge ädres

Date Designation from the Lateralers.

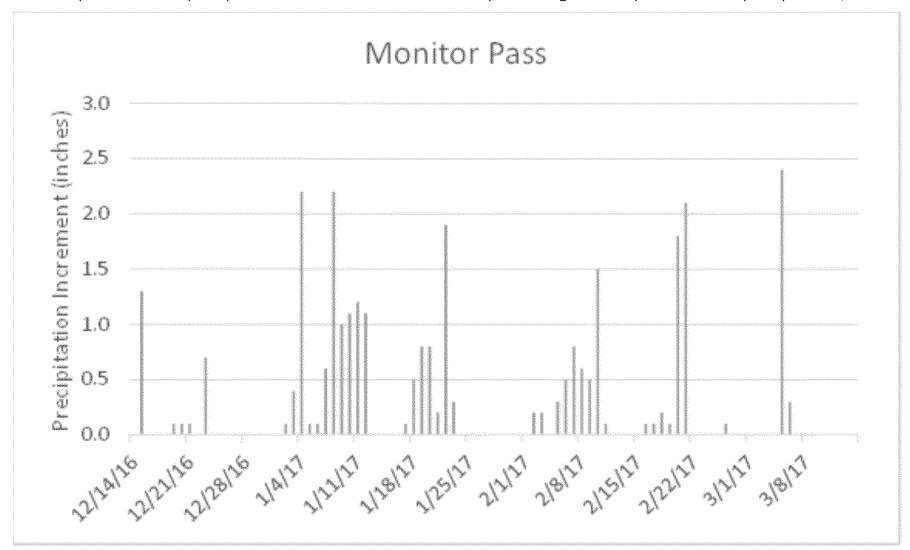
Or dealer organism level courses with the sample making

I - famed a salable reporting level for the analytical emilian con-

HO: Hal extratre at the equatory land, exceded table very HO: eperant of the reputably bend

Precipitation Mid-December through Mid-March

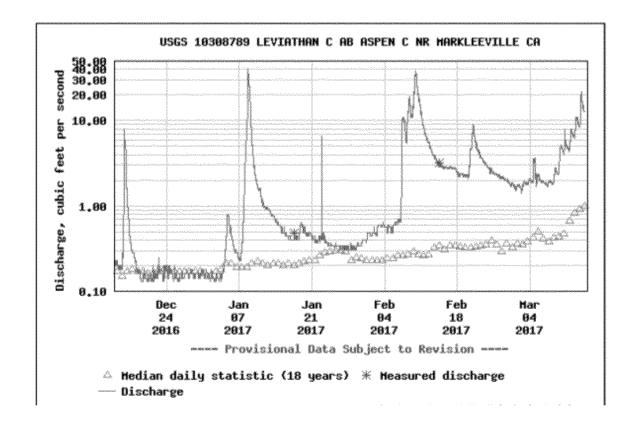
Precipitation measured by the Monitor Pass SNOTEL station for the last three months (December 13, 2016 – March 13, 2014) shows that daily incremental precipitation exceeded 1 inch on 12 days. The highest daily incremental precipitation, 2.4 inches, occurred on March 5.



Streamflow and Water Quality Mid-December through Mid-March

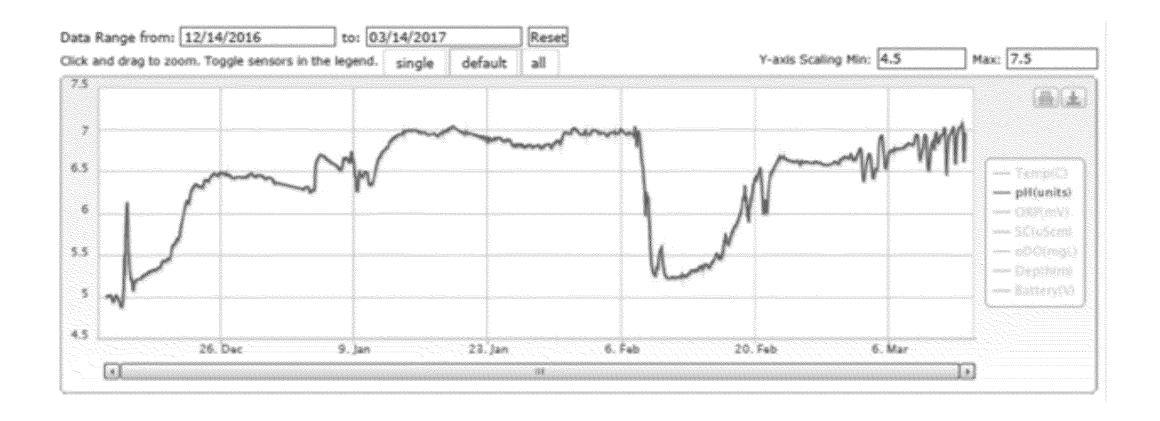
Streamflow in Leviathan Creek is measured at Station 15, the USGS gaging station downstream of the beaver dam/pond complex but upstream of the confluence with Aspen Creek. Periods of elevated streamflow generally followed precipitation events, but streamflow is not proportional to precipitation. Precipitation can fall as rain or snow. Rain, particularly rain on snow, causes greater streamflow than does snow. Streamflow can also be produced by snowmelt during periods of no precipitation. The most recent period in which streamflow increased from about 2 cfs to about 20 cfs appears to be caused by snowmelt. Precipitation was not measured at Monitor Pass March 7-13, yet streamflow increased throughout this period, reaching a maximum value of 21 cfs on March 13. There is also a diurnal pattern with streamflow generally increasing during the day and declining during the night, which is characteristic of snowmelt. Although treated pond water may have been discharged in late February or early March, the discharge would be small relative to the total measured flowrate. As a point of reference, 100 gallons per minute is approximately 0.2 cfs.

The measured streamflow was greater that the median flowrate throughout most of this period.



The February 9-10 38 cfs (17,000) peak is the third largest flow event recorded at this site. The largest flow, 68 cfs (30,500 gpm) was measured December 31, 2006, and the second, 40 cfs (18,000 gpm), was measured January 8, 2017. Other relatively large flowrates >20 cfs occurred in 1999, 2010, 2011, and 2016.

pH variations during this period are more complicated than the SC variations. During mid-December, pH gradually increased from about 5 to 6.5 standard units and had a short term increase to about 6.1 associated with the December flow event during this gradual increase. pH was relatively stable at approximately 6.3 to 6.5 until the flow event the week of December 31. During the flow events that occurred the weeks of December 31 and January 7, pH increased from about 6.3 to 6.7, and then declined and fluctuated between about 6.3 and 6.5. pH increased from about 6.3 on January 11 to 7.0 on January 14 and remained fairly constant at 6.8 to 7.0 until February 7, then declined to about 5.3 on February 9 during a high flow event, increased to approximately 6.5 on February, and fluctuated between 6.4 and 7.0 through March 13.



Contingency and Monitoring Plan

Both ARC and Waterboard conduct a monthly site visit. During each event, field observations indicated that adequate pond storage was available, and there was no indication of beaver dam failure or restriction of the Leviathan Creek Culvert.



Photograph 6: Leviathan Creek Culvert Looking Downstream

ARC visits	RWQCB Visits
December 2, 2016	January 17, 2017
January 6, 2017	February 14, 2017
February 1, 2017	February 26, 2017
March 2017, TBC	March or early April, 2017 TBC

Water Quality

Water quality parameters specific conductance (SC) and pH (as well as other parameters) are measured by U.S. EPA's water quality monitor adjacent to the streamflow station. SC declined abruptly during periods of high streamflow, and was relatively stable between high flow events. The cause of the short term spikes in SC March 5 and March 10 has not been identified.



ARC Oversight Early Response Actions

Aspen Seep Bioreactor	HDS Plant
ncrease in flow through the ASB Treatment System; nigher flows are expected during most of 2017	HDS does not operate during the winter months
-More consumables (Ethanol, NaOH, and propane)	Increased flow rates of CUD and DS
-Remote monitoring	Higher than average initial volume of Pond 4
adjust chemical dosing for changing flow rates -Access via snowmobiles	Increased use of consumables (lime, flocculant, diesel, fresh water).
-Increased flows do not appear to affecting operating effectiveness.	Site access/ treatment season could be limited
-Continue to monitor for system effectiveness	

EPA ContactInformation

EPA's Superfund Toll-Free telephone number 1-800-231-3075

Lynda Deschambault (415) 947-4183 deschambault.lynda@epa.gov

EPA's Web page: www.epa.gov/region09/LeviathanMineSite

Information Repositories

Douglas County Library 1625 Library Lane Minden, NV 89432 (775) 782-9841 EPA Superfund Records Center
75 Hawthorne Street (3rd Floor)
San Francisco, CA 94105
(415) 536-2000